THURSDAY, JULY 27, 1899.

INORGANIC CHEMISTRY.

Lehrbuch der Anorganischen Chemie. Von Prof. Dr. H. Erdmann. Pp. 728. (Brunswick: Vieweg und Sohn, 1898.)

THIS book is based upon the well-known work of Gorup-Besanez, the last edition of which was published in 1878, but it is practically a new book. It is printed in the style of Roscoe and Schorlemmer's treatise, handsomely illustrated, and well bound. In the 728 pages a vast amount of information is given about the facts of inorganic chemistry, and this information is in most respects well abreast of the time. The treatment and presentation of the subject are quite orthodox, except in so far as the description of experiments and of technical applications is separated from the main text, and printed in smaller type after the more general and descriptive account of a substance or group of substances has been written.

It is, perhaps, asking a good deal that a new book on inorganic chemistry should differ much except in size or price from contemporaneous works on the same subject. A perusal of the present work proceeds without any sense of freshness until the sections on helium and argon, where for the first time the personal authority of the writer is felt and approving interest excited. After this the even tenor is resumed until the second part of the work dealing with the metallic elements is reached. Here again interest is aroused, and the author may be congratulated on having produced a very readable account of what, scientifically speaking, is usually the dullest part of a book on inorganic chemistry. The accounts of technical applications which are intercalated in the text are very well written, interesting, and trustworthy.

The chief question raised by this book is how far theory is to be introduced into a book on inorganic chemistry. Is a book on inorganic chemistry to be a compendium of facts, whilst the theory is to be sought in books on general or physical chemistry? As a matter of fact, books on inorganic chemistry written up to about 1870 included a discussion of all that was known of theoretical and physical chemistry. Till then the only important quantitative laws that were clearly established referred to composition, and accordingly the theoretical part of such books dealt mainly with the laws of chemical combination and the atomic and molecular theories. But things have advanced since then; we now know a great deal about chemical dynamics, and it seems anomalous that in such a book as the one under notice there should be no general exposition of the laws governing chemical reactions and chemical equilibrium. These laws, like the laws of composition, are fundamental, and the light they throw on every-day inorganic chemistry is indispensable for a right apprehension of the facts. There seems no good reason for neglecting them in a book of 700 pages dealing with inorganic chemistry.

The theoretical part of the book is also in other respects the least satisfactory feature. It displays much of the anxious striving, to which some minds seem peculiarly liable, to be fundamental and logical on points where such exercitation is quite unnecessary and unfruitful. An advanced student surely does not need to be carefully initiated into the difference between Roman and Arabic numerals, or the meaning of 10^6, or the impossibility of putting a quart of liquid into a pint pot; yet these and like matters are gravely and lengthily expounded. The effect is to submerge the salient points of doctrine in a sea of tedious disquisition. One cannot but wish that the space so used had been saved for the discussion of such important theoretical matters as the constitution of ozone, the hydration of salts, the absorption of hydrogen by metals, the atomic weight of tellurium—topics to which justice is not done in the book.

There are some omissions and a few mistakes in the book. The account of flame includes the apparently ineradicable dogma that the hydrogen of a hydrocarbon burns preferentially to the carbon, and that solid particles of carbon are burnt up in the mantle. The rate of the explosive wave is confused with the velocity of inflammation, and the acetylene flame, which readily melts a platinum wire, is stated to be peculiarly cool. The blemishes in the book on matters of fact are, however, not many; the information is indeed, on the whole, admirable, and we have no doubt that Prof. Erdmann's work will on this account meet the requirements of a large class of students. A. S.

MARINE BOILERS.

Marine Boilers. By L. E. Bertin; translated and edited by L. S. Robertson, with a preface by Sir William White, F.R.S. Pp. xxviii + 437. (London: John Murray, 1898.)

THIS is a translation, with some important alterations and additions, of M. Bertin's well-known work on marine boilers. M. Bertin, now Director of Naval Construction for the French Navy, was previously Principal of the *École d'application du Génie Maritime*, and his text-book was the outcome of the course of lectures on boiler construction which he delivered to the students of that institution.

The work has been translated by Mr. L. S. Robertson, an authority on the so-called water-tube boiler, and has the advantage of a graceful tribute to M. Bertin's skill as an engineer and naval architect in the form of a preface by Sir William White, Chief Constructor to the British Navy.

The book is copiously illustrated, but unfortunately the plates are sometimes by no means clear, and where dimensions are given it is often impossible to read them; as the illustrations are reproductions of those in the original French work, the dimensions are in metric units, while all the dimensions in the text have been converted into English units. Fewer illustrations, more clearly reproduced, would have been an improvement; though these remarks apply in the main to the general drawings only, the detail drawings being much clearer.

The author has divided the book into four parts, and has covered fairly completely the whole field. Part i. is devoted to the important subjects of combustion, trans-

mission of heat, corrosion, &c., and to the various methods for producing draught, with a discussion of the advantages and disadvantages of the various systems.

On p. 45 there is a slip, probably arising in conversion of units: it is stated that 5·89 lbs. of oxygen are needed to burn a pound of carbon; the figure should be 2·67 lbs. In discussing the possibility of the utilisation of the heat passing away up the funnel for warming either the feed water or the air before it passes into the furnace, there is a somewhat curious remark about the heat wasted in condensing the exhaust steam from an engine by cold water in the condenser, the author stating that so far "no remedy for this evil" had been proposed. Surely it has been forgotten that since the engine can only convert into work a small portion after all of the heat it receives, there must be rejection of heat in the condenser or elsewhere. In discussing the effects of corrosion in tubes, it is laid down as an axiom that only solid drawn tubes should be used, on account of the liability of the welded tube to suffer injury by corrosion along the line of weld, a remark which is sadly significant after the late disaster to a boiler in H.M.S. *Terrible*, and the finding of the Court of Inquiry.

The next two parts deal in detail with the older forms of marine boilers, the Scotch boiler mainly, and the newer tubulous or water-tube boiler. Very full descriptions are given in the second section of the more important details in a cylindrical boiler, especially in regard to the tubes and to the stays, and the section concludes with a valuable table of weights, space occupied, &c.

The third section, on water-tube boilers, is the most complete and the most interesting, as was to be expected, the tubulous boiler now reigning almost supreme in the French navy, and its use in the French mercantile marine being fairly large. Three classes of such boilers are described in three separate chapters—the limited circulation class, type Belleville; the free circulation, types Niclausse, Babcock-Wilcox, &c.; and lastly the accelerated circulation, types Normand, Thornycroft, Yarrow, &c.

In each chapter practically every boiler of the class under description which has been actually tried in practice is illustrated and briefly explained, while very full detailed descriptions are given of one or two of the important forms, such as Belleville, Niclausse, Thornycroft, &c., with much valuable information as to their performances under steam.

The last chapter in Part iii. is devoted to an able summary of the advantages and disadvantages of the tubulous type of boiler, mainly, of course, from the point of view of the marine engineer; interesting contrasting figures of comparative weights, costs, &c., per square foot of grate render this chapter one of the most useful in the book. It is surprising how cheap these apparently complex water-tube boilers are, averaging 32*l.* per square foot of grate surface.

The four chapters in Part iv. are devoted to descriptions of boiler mountings and fittings, in particular to the automatic feed arrangements, so essential to many water-tube boilers; in these chapters the illustrations are very good.

The book undoubtedly is the most complete work on the subject issued in English up to the present, and is well up to date; it should prove a valuable work of reference, not only to the marine engineer, but to the intelligent layman who takes an interest in the efficiency of our navy. The water-tube boiler, much as Mr. Allen may dislike it, has come to stay; in our navy it will gradually displace the old Scotch boiler, and we should be surprised if it does not eventually make headway in the mercantile marine.

Any one reading the book and anxious to ascertain the trend of opinion amongst English marine engineers on this important question should consult the papers read a month or two ago before the Institution of Civil Engineers by Mr. Milton and Sir John Durston.

H. B.

OUR BOOK SHELF.

The Elements of Euclid. With Notes, &c., by I. Todhunter, D.Sc., F.R.S. New edition, revised and enlarged, by S. L. Loney, M.A. Pp. viii+332, cxxxii. (London: Macmillan and Co., 1899.)

Essentials of Plane and Solid Geometry. By W. Wells, S.B. Pp. viii+392. (London: Isbister and Co. Boston, D.C.: Heath and Co., 1899.)

WITHOUT altering the general character of the well-known text-book with which he has had to deal, Mr. Loney has succeeded very well in bringing it up to date. The appendix has been enlarged by the insertion of sections on poles and polars, harmonic ranges, inversion, coaxal circles, &c.; the number of exercises has been doubled, and, what is more important, the really valuable exercises have been starred and hints given for the solution of many of them. To teachers of the conservative school this new edition ought to prove very acceptable.

Mr. Wells' book is of quite another stamp. The author belongs to the progressive party, and makes no scruple of using hypothetical constructions or any abbreviations he finds convenient. In treating of parallels he uses Playfair's axiom, and the discussion of ratio and proportion is distinctly arithmetical. The exercises are numerous and often accompanied by figures; hints for solution are also given in many cases. Mr. Wells writes in a fresh and independent manner, and his book seems very likely to interest a student and develop any geometrical power he may have in the right way.

In another edition the author will, we trust, suppress the appendix (p. 386), which is almost entirely vitiated by an error of reasoning. Mr. Wells proposes, for instance, to prove that the circumference of a circle is less than the perimeter of any circumscribed polygon, and proceeds thus: "Of the perimeters of the circle and of its circumscribed polygons, there must be one perimeter such that all the others are of equal or greater length." He then proves that, given any circumscribed polygon, we can construct another one with less perimeter; and then infers the truth of the proposition. As a matter of fact, the statement quoted above is not justifiable; the perimeters of the polygons form a manifold, and this does not necessarily contain a least element; indeed, Mr. Wells shows that it does not. There may be a definite lower limit to the perimeter of a circumscribed polygon: even then, Mr. Wells brings forward no argument to show that this lower limit exists; still less that it is equal to the circumference of the circle. Strictly speaking, he brings the circumference of the circle into no relation of equality or inequality with any of the polygons: it just stands by itself at the end as at the beginning. It is as if one said: "We have a set of quantities x, 1·3, 1·33, 1·333, &c.; one of these must be at least equal to any of the rest. But this cannot be any of the decimals, because if we choose,